

subjects, of which a candidate may take up two, and in each of which 2000 marks may be made.

Botany is taught at Coopers Hill, and (according to the Calendar of the College) it forms one of the "special auxiliary subjects" for the forest student. I do not wish to say a single word in depreciation of the botanical teaching at this college, which is probably excellent of its sort. I do not know what value, as part of their professional equipment, students are accustomed or encouraged to attach to the possession of the means of acquiring a knowledge of the trees and shrubs in the midst of which they are to pass their lives in India. But this I do know, that the ordinary forest officer educated in England now arrives in India without sufficient knowledge to enable him to recognise from their botanical characters the most well-marked Indian trees. To tell such an officer the name of the natural family to which a plant belongs conveys no information to him whatever, for he knows nothing of botanical affinities. Moreover, the forest officer after he has arrived in India is not encouraged to familiarise himself with the contents of the forests under his charge. This will be better appreciated by giving an example than by any number of remarks. Some three years ago, Mr. J. S. Gamble (a forest officer) published a monograph of the bamboos of British India. From bamboos, as you may possibly be aware, a very large amount of forest revenue is annually derived. The sales of bamboos for the year 1896-97 amounted to no less than 110 millions of stems. A great number of the species of bamboos have the curious habit of flowering gregariously at remote intervals of thirty or forty years, and the flowering is followed by death. The absence from the forests for years in succession of flowers of a number of the species, and the similarity of many of them in leaves, had hitherto made members of the group most difficult of identification. Mr. Gamble had devoted himself to their study for many years. He had carefully examined all the previously collected materials stored in the herbaria at Kew, the British Museum, Calcutta and elsewhere; and large special collections had been made for him by Mr. Gustav Mann and other officers of the Government. Moreover, he had General Munro's great paper in the *Linnean Transactions* as a basis. Mr. Gamble's work was undertaken with the full approval of Sir Joseph Hooker, who indeed accepted Mr. Gamble's account of the bamboos for his "*Flora of British India*." Mr. Gamble's monograph is illustrated by a life-sized drawing of each species, with analyses of the flowers on a larger scale. When completed, the book was published as one of the volumes of the "*Annals of the Calcutta Botanic Garden*." In consideration of the supposed great importance of the book to the forester, and in the belief that the copies would be eagerly taken by the Forest Department, an extra hundred copies were printed, and these hundred copies were put into stout canvas binding suitable for camp use. These copies, or as many of them as he cared to take, were offered to the head of the Forest Department in India at the reduced price of fifteen rupees per copy. The result was an official refusal to buy a single one, although the purchase of the whole hundred (which was not asked for) would have cost only fifteen hundred rupees—a sum which would have reduced the revenue of the year by about one twelve-thousandth part! An appeal against this ruling having been made to a still higher authority, a modified order was subsequently issued permitting such forest officers as desired to possess the book to buy copies and charge the cost in their office expenditure. I may state that the book was not a private venture. It was produced at the expense of the Government of Bengal.

It is not because I like to play the censor that I have made these remarks about the Forest Department. Having myself served in it from 1869 to 1871, I can speak from my own experience as to the value, from the utilitarian point of view, of a knowledge of the names, affinities and properties of the trees, shrubs and herbs which compose an Indian jungle, and of a knowledge of these as individual members of the vegetable kingdom rather than as masses of tissue to be studied through a microscope. The appointment which I held in India for twenty-six years after leaving the Forest Department gave me full opportunity of getting into touch with all who interest themselves in a knowledge of plants, and of discovering how few of these at the present day are forest officers. The majority of the latter, if they love their trees, are content to do so without knowing their names or relationships! There are, of course, splendid exceptions who know as well as love. The general decadence of the teaching of systematic botany in England during the past

twenty years is, perhaps, to some extent the cause of the low estimation in which the science is held by the authorities of the Indian Forest Department. Twenty-five years ago systematic and morphological botany, no doubt, had too great prominence given to them in the teaching at universities and colleges of this country, and the other branches of botanical science were too much neglected, although I do not think they were despised. Now it appears to me that systematic botany is too much neglected. I hope it is not also despised! Few of the systematists who survive in England are now to be found attached to the universities. They are mostly clustered round the two great herbaria in London; and such of them as have to look to systematic botany for the means of livelihood are not in the receipt of salaries such as one might reasonably expect in one of the richest countries in the world!

CHEMISTRY AT THE BRITISH ASSOCIATION.

DESPITE the fact that the Dover meeting was a comparatively small one, the chemists formed a thoroughly representative gathering, including amongst distinguished foreigners Prof. Lemoine, of Paris; Prof. Fittig, of Strassburg; and Prof. Ladenburg, of Breslau. The able address of the President, Dr. Horace T. Brown, on the assimilation of carbon by the higher plants, which embodied most valuable and original contributions to the knowledge of the complex changes which go on in the living cell, introduced a subject somewhat beyond the usual scope of the proceedings of the Section; and whilst the chemists present at Dover will always look back upon the address with a special appreciation, they will be equally mindful of the many interesting contributions on kindred subjects for which the personality of the President was in the main responsible. Prof. Hanriot, the President of the Chemical Section of the French Association, communicated a short account of the excretory products of plants, in which he discussed the mutations of nitrogen in the vegetable kingdom as based on his own observation of the occurrence of asparagine amongst the secretions of plant roots; when passed into the soil this product would in all probability become oxidised to nitrates, and thus become directly available for plant life. The experimental confirmation of this view is in course of study. The chemical processes involved in the saccharification of starch by malt-diastase were discussed by Dr. A. Fernbach, of the Institut Pasteur, and by Dr. G. H. Morris. The former detailed his observations on the influence of acids and of some salts on saccharification, which led him to the conclusion that the slightest trace of any free acid retards the action of diastase on gelatinised as well as on soluble starch, provided both the starch and diastase are free from salts on which the added acid may act; but if the solution contains salts, such as secondary phosphates, which are distinctly unfavourable to diastatic action, the addition of acid is favourable as long as there is no excess over the quantity necessary to transform these salts into the primary phosphates. The President regarded these results as opposed to his own observations on the subject, and considered further details of the experiments necessary to justify the conclusions. Dr. G. H. Morris, in a paper on the combined action of diastase and yeast on starch granules, showed that similarly to the symbiotic action of diastase and yeast on the so-called stable dextrin, ungelatinised intact starch granules, when submitted to the joint action of diastase and yeast, are fermented to a large extent, the maltose first formed being converted into alcohol. The addition of a small quantity of yeast to a cold water malt extract more than doubles the percentage of starch that is changed, and this increased action is not due to any greater activity of the diastase that might result from the removal of the soluble product formed (maltose) from the sphere of action. It appears necessary to have both the diastase and the yeast present together in a condition capable of exercising their respective functions for the increased action to occur. The action of acids on starch was also discussed by Dr. Morris, who showed that maltose is always obtained as a product of hydrolysis together with dextrin and dextrose; this is in opposition of H. Johnson's statement that the two latter compounds are the sole products of the action. But the most interesting contribution to this branch of chemistry was the joint discussion with Section K (botany) on symbiotic fermentation, on the occasion of the visit of the French Association. The discussion

was opened by Prof. Marshall Ward, who was followed by Sir Henry Roscoe, Prof. Armstrong, M. van Laar, Prof. Reynolds Green, Prof. Warrington, M. Tanret, Prof. Francis Darwin and Dr. G. H. Morris. There is little doubt that the discussion has led to a more exact recognition of the division and relations of symbiotic changes, which should serve to develop the study of the subject. Prof. Marshall Ward, after considering the conditions under which symbiosis exists both in the vegetable and animal kingdoms, passed to the more special subject of symbiotic fermentations. Prof. Ward instanced the various grades of symbiotic association that may be recognised, suggesting a special nomenclature, and concluded his remarks with the consideration of the physiology of the subject. The many possibilities that may arise in the mutual life of symbiotic organisms—such as the provision of definite food material by one symbiont for the other, or the advantage derived from a protective influence, or, finally, the exertion of a stimulating action—were discussed, with the conclusion that there is some evidence to support the hypothesis that one symbiont may stimulate another by excreting a body which acts as an exciting drug to the associated organism. The chemical aspect of the subject was concisely treated by Prof. Armstrong, who pointed out that there is an absence of positive evidence to show that one member of a pair of symbiotic organisms does more than prepare the way for the other by effecting a change which the second is incapable of inducing. The possibility of chemical interaction playing a part in symbiotic changes and the hydrolytic function of enzymes were clearly brought out, and illustrations of allied changes of a purely chemical character instanced. Prof. Armstrong pointed out that no case has yet been observed in which a substance is attacked by a pair of organisms neither of which can attack it singly, and regarded it as probable that associated molecules undergo change under the influence of a single organism or agent which determines their association. Prof. van Laar, on the other hand, expressed the view that symbiosis was rather a case of parasitism. Dr. Calmette's contribution on industrial symbiotic fermentations was read, in his unavoidable absence, by Sir Henry Roscoe. In this paper an account was given of the methods for the conversion of starch into alcohol by the association of pure cultures of moulds with pure yeast cultures, and the industrial application of this symbiotic relation. Both in France and in Belgium thousands of tons of starch are now converted into alcohol by this method, and most favourable results have been obtained both as regards yield and quality. In inorganic chemistry Prof. Dewar's important experiments on the solidification of hydrogen stands foremost; an account of these researches has already appeared in *NATURE*. Colonel Waterhouse contributed a note on a remarkable result he has observed on the exposure of metallic silver to light; a visible image results on the exposed plate after prolonged exposure, but the effect may be recognised in a very much shorter space of time by the development of the latent image produced. An important discussion on the proposal of establishing an International Committee on Atomic Weights was initiated by Prof. F. W. Clarke in the form of a letter to Prof. Tilden, who himself contributed a critical *résumé* of both the theoretical and practical aspects of the question. In view of the proposed discussion of the subject at the Congress of Chemists to be held in Paris next year, Prof. Clarke's proposal for an International Committee aroused much interest; but the exact scope of its work appeared difficult to define in the minds of Sir Henry Roscoe, Prof. Fittig, Sir William Crookes and others who participated in the discussion. The desirability of encouraging all capable of undertaking the redetermination of atomic weights was fully recognised, but such work could not be ordered. This view, of course, referred to the theoretical part of the problem; Prof. Tilden's suggestion regarding the desirability of an understanding as to the numbers to be chosen for ordinary use was somewhat lost sight of by many of the speakers, especially his important addendum that the values arrived at in atomic weight determinations are obtained under conditions which cannot be observed in daily laboratory practice, and that the adoption, therefore, of numbers regarded as the most exact does not of necessity contribute to the exactness of ordinary analytical observations. Dr. Gladstone's report on the teaching of natural science in elementary schools was followed by an interesting discussion; Dr. Gladstone, in conjunction with Mr. Hibbert, also contributed a paper dealing with some peculiarities in the drying of colloids such as the hydrates of silica, tin, titanium, iron and alumina.

The papers, reports, and discussions dealing with organic chemistry were of more than usual importance. Prof. Hartley read the first report of his committee on the absorption spectra and chemical constitution of organic substances, which, in addition to the work of the committee, contains a valuable summary of that of other investigators. The committee on the action of light upon dyed colours issued their final report, which completes a long series of important experiments carried out chiefly by Prof. Hummel. Prof. Armstrong opened a discussion on laws of substitution, especially in benzenoid compounds, in which the conditions of substitution in amines and phenols were dealt with. The course of the reaction in those cases in which ortho- and para-compounds, on the one hand, and essentially meta-compounds, on the other, result were discussed, and the possibility of the formation of intermediate products in the former case which subsequently undergo isomeric change fully considered. Prof. Armstrong also contributed papers on the relative orienting power of chlorine and bromine, and on isomorphism in benzene sulphonic derivatives. Extremely interesting isomorphous relations have been observed amongst these latter compounds, and a committee was appointed by the Section for their further investigation. Mr. Fenton read a summary of his researches on oxidation in presence of iron, in which the extension of his reaction to tartronic, lactic, glyceric and malic acids was referred to, and, in conjunction with Mr. Jackson, described the condensation products obtained from glycollic aldehyde under the influence of dilute alkali. β -Acrose appears to be formed when a 1 per cent. solution of caustic soda is used, whilst a starch-like product results when the aldehyde is heated to 160°–170°. Messrs. Morrell and Crofts gave an account of further experiments on the action of hydrogen peroxide on carbohydrates in presence of iron salts, the most interesting result obtained being the formation of a dibasic six-carbon atom acid from glucosone. Special interest centred in a paper by Mr. W. J. Pope on the influence of solvents on the optical activity of organic compounds, in which he traced the variations in the specific rotation of an optically active substance dissolved in various solvents to the degree of association of the active compound, and on this association factor founded a method for determining whether a particular optically active substance forms a liquid racemic compound with its optical antipode. Mr. Pope also described a new method for resolving racemic oximes into their optically active components, and Dr. M. O. Forster gave an interesting account of his researches on the influence of substitution on optical activity in the bornylamine series. Dr. Forster also described some new derivatives of camphoroxime, the chief interest of which lies in their relation to certain oxidation products of camphor. Dr. C. A. Kohn and Dr. W. Trantom, in a paper on the action of caustic soda on benzaldehyde, showed that, in the absence of water or in the presence of an excess of aldehyde, benzyl-benzoate is formed as a product of the decomposition; its production points to the formation of an intermediate ortho-compound in the reaction commonly employed in the preparation of benzyl alcohol. Prof. Emerson Reynolds described some new silicon compounds obtained by the action of ethyl mustard oil on silico-phenyldi-imide, and Prof. Ladenburg read a summary entitled "The development of chemistry in the last fifteen years," in which the advances of the various branches of the science during that period were dealt with. Of more general interest was a paper by Prof. Clowes on intermittent bacterial treatment of raw sewage in coke beds, which was followed by one by Mr. W. Scott-Moncrieff on the place of nitrates in the biolysis of sewage. Both papers, as well as the report of the committee on water and sewage examination results, led to an interesting and useful discussion. In a paper on the chemical effect on agricultural soils of the salt-water flood of November 29, 1897, on the East Coast, by Messrs. T. S. Dymond and F. Hughes, the remarkable result was recorded that although the proportion of salt left on the soil was insufficient to prove injurious to the growing crops, the earth-worms in the soil were entirely removed, with the consequence that very few crops were worth harvesting the following year. This year nine-tenths of the salt originally present has disappeared from the soil, and young worms have again made their appearance, but still the condition of the soil remains unsatisfactory, the rate of percolation of water through the flooded soil being only half as rapid as through the unflooded. This the authors trace to the action of the chlorides of the sea water on the double silicates of the soil with the formation of silicate of alumina in a gelatinous condition,